A Study on Design Strategies of Vernacular Architecture Based on Data Analysis of Community's Architectural Preference

PAN Xi^{1, a}, XIAO Xiao^{1, b*}, SUO Jingxuan^{1, c}

¹School of Architecture and Design, Beijing JiaoTong University, Beijing

ABSTRACT-With the putting forward of cultural power and rural revitalization as China's national strategies, rural construction under the conservation of traditional culture has become an important issue. In the design of contemporary vernacular architecture, more and more architects have realized the principle position of local community, and understanding its architectural preference has been an important task. Using both qualitative and quantitative research methods such as digital modeling, questionnaire and data mining, this paper takes a Naxi ethnic community as an example and investigates the community's architectural preference, analyzes and interprets its characteristics, and then puts forward corresponding strategies for the design of contemporary vernacular architecture in this area.

1 Introduction

1.1 Vernacular Architecture in the Context of Cultural Power and Rural Revitalization

In recent years, rural construction has become a very important issue in China, of which the inheritance and development of traditional rural culture is an indispensable part. Since the Sixth Plenary Session in 2011, the preservation and revitalization of traditional rural culture has become an important task with the "cultural power" being put forward as a national strategy. In 2017, the strategy of rural vitalization was put forward as well, and one of its important significance is to "inherit the excellent traditional Chinese culture". In 2018, the Strategic Planning of National Rural Revitalization (2018-2022) was released, and clearly proposed to conserve traditional villages and buildings^[1]. As vernacular architecture is one of the most important material carriers of traditional rural culture, the inheritance and development of vernacular architectural tradition is also a vital task to achieve the development of rural areas and the revitalization of their traditional culture. Therefore, to work out appropriate design strategies of vernacular architecture in this context has been topping the agenda for Chinese architects today.

Since the 20th century, many architects have been committed to the design of new vernacular architecture—taking regional tradition and vernacular architectural forms into consideration during the design of contemporary architecture. For example, the Indian architect Charles Correa advocated the use of appropriate technology in architectural design, to create a spatial sequence adapted to the logic of local life and against India's hot climate^[2]; the Chinese architect Wang Shu has

done a lot of work to transform traditional architectural forms into contemporary architectural language, and use both traditional and modern materials and techniques to create architecture representing both tradition and modernity^[3]. With the further development of new vernacular architecture design, reflection on this architected mode is also unfolded. Some scholars point out that while most architectural practice in rural area is dominated by architects are highly idealized, new vernacular architecture has become the nostalgia of elite rather than a place for the real life of local people^[4]. Some scholars find that with the implementation of the national strategy of rural vitalization, the government is playing an increasingly important role in rural construction, which also brought social capital into rural area. Although, based on the decision-making theoretical model, projects led by the government are more likely to make the minimum cost and the maximum profit, the local people's ideas have less chance to get fully expressed^[5]. Therefore, an increasing number of architects have realized that in the design of contemporary vernacular architecture, more emphasis should be placed on local communities. With the needs and architectural preference of the community members being fully considered, their design works would be better accepted by the users^[6].

In fact, as architecture without architects^[7], vernacular architecture is a tradition shared by local people, created by generations of community members in their long-term practice of adapting to the natural and social environment and building themselves desired home. It is the community members who create and inherit the vernacular tradition, while the architects' design practice is actually a kind of intervention to the existing tradition. It is necessary for architects to fully understand the local peoples' cognition of their architectural tradition, so that the design works

^apanxi@bjtu.edu.cn

^b18126387@bjtu.edu.cn

^c19126370@bjtu.edu.cn

could be better accepted, used and maintained. Therefore, taking an ethnic community as an example, this paper investigates and analyzes the community's preference for vernacular architecture through the methods of architecture study, community survey and data mining, and puts forward three strategies for the design of vernacular architecture in this area.

1.2 Naxi Vernacular Architecture

This study was carried out in rural communities of Naxi people, an ethnic group in Southwest China. Naxi people live in the north-western part of Yunnan and border region of Sichuan, Tibet, especially the middle reaches of Jinsha River^[8]. Living in the complex natural and social environment in this mountainous and multi-ethnic area, Naxi people have developed various forms of vernacular architecture, which fully shows their building skills and wisdom in dwelling. Among the different forms of Naxi vernacular architecture, the wood-framed house is the most widely used one, and construction activities of it are still very active nowadays, which provides ample samples for this study. Therefore, this paper will focus on wood-framed houses of Naxi people.

Figure 1: Naxi Vernacular Architecture (source: author)

Naxi people began to develop their tradition of wood-framed architecture under the influence of Han people around the 17th century^[9]. Naxi houses are usually organized following the general pattern of 'siheyuan' courtyard. And different types of wood frames patterns such as Minglou, Manlou, Qishalou and Menlou are used combined with different types of eaves (shazi) to achieve the desired form of the building^[10]. In most cases, the exterior walls are made of adobe brick, interior partitions are made of wood, and the roof is paved with tiles. But other forms of these elements are also widely seen to meet the diverse demands and architectural preference of people (Fig.1).

2 Investigation

2.1 Study of Construction Tradition

First of all, the construction tradition of Naxi vernacular architecture is systematically studied. After field work in 22 traditional villages, the construction process of a typical

Naxi residential building is divided into five stages, which involves 76 crafts of 22 building elements (Fig. 2).

Construction Stage/Architectural Element/Building Options

1.Construction of Foundation	1.1 Base	A. Ashlar B. Rubble
	1.2 Layout	A. Three-Bay House B. Three-Bay House With One Annexe C. Three-Bay House With Two Annexe
2.Construction of Carpentry Work	2.1 Structure	A. Minglou B. Manlou C. Qishalou D. Reinforced Concrete Structure E. Steel Frame
	2.2 Shazi(Eave)	A. Qisha B. Diaosha C. Guasha D. Wusha E. Liangmiansha
3.Construction of Roof	3.1 Roof	A. Color Steel Tile B. Flat Tile C. Flat Tile+Round Tile D. Flat Tile+Round Tile+ Round Eaves Tile E. Flat Tile+Round Tile+ Round Eaves Tile +Triangular Eaves Tile
	3.2 Centre of the Ridge	A. Undecorated B. Tile Cat C. Tile Cat+ Stacked Tiles
	3.3 Ends of the Ridge	A. Round-Eaves-Tile Decoration B. Dragon Ridge Decorations C. Undecorated
	3.4 Board of Cornice	A. Red Paint B. Blue Paint C. Yellow Paint D. Green Paint E. Varnish F. Sheet Steel
4.Construction of Wall	4.1 Infill of the Exterior Wall	A. Black Brick B. Hollow Brick C. Adobe Brick D. Stone E. Red Brick
	4.2 Facing of the Exterior Wall	A. Unvarnished B. Whitewashed C. Tile Fixing
	4.3 Gable Wall	A. Undecorated B. Decorated
	4.4 Chengsha Wall	A. Shazichushan B. Shazixuanshan C. Wushawuqiang
5.Construction of Decoration	5.1 Enclosure of the Second Floor	A. Fully-Open B. Fully-Close C. One-Side-Close D. One-Side-One-Middle-Close E. Two-Side-Close
	5.2 Infill of the Interior Wall	A. Adobe Brick B. Black Brick C. Plank D. Hollow Brick E. Red Brick
	5.3 Facing of the Interior Wall	A. Unvarnished B. Whitewashed
	5.4 Shakong	A. All-Cover B. Vertical-Boards
	5.5 End of Beam	A. Undecorated B. Decorated
	5.6 Color of the Pillars	A. Varnish B. Red Paint C. Yellow Paint
	5.7 Color of Doors/Windows	A. Red Paint B. Yellow Paint C. Varnish
	5.8 Doors	A. Folding Door B. Sliding Door
	5.9 Ornaments	A. Flower-Type B. Beauty-Type C. Antique-Type D. Geometry -Type
	5.10 Windows	A. Casement Window B. Sliding Window C. Fixed Window

Figure 2: Construction Process of Naxi Vernacular Architecture (source: author)

2.2 Questionnaire Design

Based on the study of the construction tradition, a questionnaire is designed to investigate the community members' preference for different crafts of every architectural element in each construction step. In the questionnaire, crafts of the architectural elements are shown in the form of perspective through three-dimensional modeling (Fig. 3), so as to ensure that all the community members can quickly and fully understand each question of the questionnaire, no matter their age, education level and mother language. The respondents are asked to give a score between 1-9 to each craft of each

architectural element in each construction step (1 point means extremely dislike, 9 point means extremely like).

Figure 3: Example of A Question in the Questionnaire (source: author)

2.3 Architectural Preference Survey

Ciman Village, located in Gucheng District of Lijiang City, Yunnan Province, is selected as the sample community for the architectural preference survey (Fig.4). The village has a population of 1259 (2020) and is a relatively independent community with a clear boundary. Spontaneous construction activities of vernacular architecture are still active and rich forms of buildings are widely seen here.

Figure 4: Ciman Village (source: author)

The questionnaire survey was conducted in July 2020 in the form of random survey. A total of 215 questionnaires were released and 215 were returned, including 208 valid ones. Using the software spss22, the reliability and validity of the data was tested. The reliability of the questionnaire is 0.952, which shows that the questions have high consistency and reliability (Table 1). The KMO value was 0.824, and the significant coefficient was lower than 0.01, indicating a high validity of the questionnaire (Table 2). After that, the data collected was normalized; the score of each building element was scaled to 1 before the results were obtained (Table 3).

Table1: Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.952	.952	76

Table2: Kmo and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.824
Bartlett's Test of Sphericity	Approx.Chi-Square	9126.484
	df	2850
	Sig.	0.000

Table3: Statistics of Construction Preference Survey Data

Architectural Element	A	B	C	D	E	F
1-1 Base	0.494	0.506				
1-2 Layout	0.297	0.326	0.377			
2-1 Structure	0.174	0.239	0.246	0.175	0.167	
2-2 Shazi (Eave)	0.206	0.213	0.194	0.168	0.218	
3-1 Roof	0.118	0.157	0.195	0.253	0.278	
3-2 Centre of the Ridge	0.233	0.347	0.420			
3-3 Ends of the Ridge	0.365	0.413	0.222			
3-4 Board of Cornice	0.250	0.140	0.139	0.138	0.200	0.134
4-1 Infill of the Exterior Wall	0.217	0.138	0.214	0.237	0.194	
4-2 Facing of the Exterior Wall	0.302	0.397	0.302			
4-3 Gable Wall	0.432	0.568				
4-4 Chengsha Wall	0.355	0.381	0.264			
5-1 Enclosure of the Second Floor	0.227	0.176	0.226	0.187	0.184	
5-2 Infill of the Interior Wall	0.164	0.215	0.278	0.152	0.191	
5-3 Facing of the Interior Wall	0.436	0.564				
5-4 Shakong	0.517	0.483				
5-5 End of Beam	0.448	0.552				
5-6 Color of the Pillars	0.389	0.340	0.270			
5-7 Color of Doors/Windows	0.291	0.284	0.425			
5-8 Doors	0.565	0.435				
5-9 Ornaments	0.298	0.213	0.264	0.224		
5-10 Windows	0.389	0.284	0.327			

3 Discussion

3.1 Interpretation of Community's Architectural Preference

According to the statistical results, it can be seen that the community members' preference for Naxi vernacular architecture has the following characteristics.

Firstly, people generally prefer traditional decoration. The more highly decorated an architectural element is, the higher score it gets. For example, in the question about roof, the most complex way of tiling (flat tile + round tile + round eaves) gets the highest score; in the question about the center of ridge, ridge with both tile cat and stacked tiles is the most popular type. Similar results are also seen in the questions about ends of the ridge and the exposed end of the beam (Fig. 5).

Figure 5: Architectural Preference of Decoration

Secondly, in terms of materials, most community members prefer them to be presented in their natural state. For example, in the question about the base, which is usually made of stone, most people prefer rubble stone to ashlar; rubble stone is considered to be more natural and beautiful. And when it comes to the paint, compared with red paint and yellow paint, varnish gets the highest score as it can reveal the original texture of wood (Fig. 6).

Figure 6: Architectural Preference of Materials

Thirdly, most community members prefer traditional style to modern style, and whether the architectural element is in “Naxi” style is taken as an important criterion when they give the scores. For instance, among different colors of paint used on the cornice, red paint gets the highest score, surpassing varnish, which is the most popular paint in other elements, because people believe that red cornice is a critical character of traditional Naxi house. And among the three forms of chengsha wall, the first two forms which are more highly decorated get higher scores. But between these two forms, most respondents prefer the second one because it is regarded as traditional Naxi style while the other one is borrowed from Bai ethnic group. Similarly, folding doors in traditional ethnic style are more popular than sliding doors (Fig. 7).

Figure 7: Architectural Preference of Styles

3.2 Design Strategies Based on Community's Architectural Preference

From the analysis of the survey results above, we can find that in Naxi villages, the community members do not only consider vernacular architecture as a physical object to meet their needs in daily use, but also an active factor in the reproduction of their social status and ethnic identity. This "cultural consciousness"^[11] of Naxi people originates from their understanding and responding to their cultural tradition, and would affect their vision for the future life. It is a critical guarantee for the continuation of traditional culture and the sustainable development of rural society.

Therefore, in the design of new vernacular architecture, architects should understand that architecture is the presentation of the community members' social and ethnic identity, take their architectural preference into full consideration, and develop appropriate design strategies. For example, in the design of architectural form, architects should respond to the aesthetic preference of the community, and use “architectural vocabularies” with ethnic features, to explore new vernacular architecture with both aesthetic value and regional ethnic characteristics.

Secondly, more attention should be paid to application of natural and native materials. The architectural preference survey has shown that Naxi people is close to the nature and prefer natural materials much more than industrial materials. Hence, architecture with natural and native materials would be better received. Besides, the building should not be treated as an isolated object, but as an integral part of the environment where it is located.

Architects should pay attention to both the building and the environment, as well as the close interaction between them.

Thirdly, vernacular architecture is embedded into the daily life of local community. Therefore, designers of new vernacular architecture should fully consider the community's needs in different aspects such as function, aesthetic and so on, as well as the available resources (materials tools and technology etc.) people can get access to. In fact, design and construction should be unified into a holistic process^[12] based on a deep understanding of technical, social and culture factors in local conditions. In this way, the new vernacular architecture can be organically integrated into the community's daily life in multiple dimensions, and well accepted, used and maintained by community members.

What's more, it is even more important that architects need to realize that in rural areas, community-led building is still the main mode in construction, and the vernacular community is who creates, practices and inherits the architectural tradition. Therefore, their renewal and development of the existing architecture can be truly integrated into the existing architectural tradition, practiced and inherited only if it is generally accepted and approved by the community. Therefore, in the design of contemporary vernacular architecture, the needs and preferences of the community should be fully understood and respected. Besides, in the process of design practice, if architects could develop a practical mode that adapts to the existing construction customs of the community, and help to form a multipartite "building community" which includes the community, the government and the professionals, it would benefit the maintenance of a pleasant built environment and the sustainable development of rural society.

4 Conclusion

Construction activities in rural areas usually follow a bottom-up pattern in which the community members play the most important role. When architects get involved in rural construction activities, it is necessary for them to position themselves into the existing spontaneous construction system and carry out design practice under the condition of fully understanding the local community. This paper provides a way of investigating and analyzing community's architectural preference combining qualitative and quantitative methods, and also shows the possibility of using emerging technologies such digital modeling and data mining in community survey^[13]. We hope to provide architects with an idea to review the design of vernacular architecture from the perspective of community, and develop more comprehensive design strategies toward local community's preference.

Community is the principal part in the construction and development of rural areas. The design practice of contemporary vernacular architecture should be based on the rural society and fully respect the its culture and tradition. When architects participate in rural construction with an open and humble attitude, and coordinate with the community as a learner, it would be conducive to the

multi-participation, positive interaction and sustainable development of rural construction.

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